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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/769,777	SUNG ET AL.	
	Examiner	Art Unit	
	KATRINA FUJITA	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,13,16-19,22,25-30,32,34-36,39,42-45,48 and 51-57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13,16-19,22,25-30,32,34-36,39,42-45,48 and 51-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *02/11/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 11, 2008 has been entered.

Response to Amendment

2. This Office Action is responsive to Applicant's remarks received on February 11. 2008. Claims 1-10, 13, 16-19, 22, 25-30, 32, 34-36, 39, 42-45, 48 and 51-57 remain pending.

Claim Objections

3. The previous claim objections have been withdrawn in light of Applicant's amendments.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.
>
> Claims that recite nothing but the physical characteristics of a form of energy, such as a frequency, voltage, or the strength of a magnetic field, define energy or magnetism, per se, and as such are nonstatutory natural phenomena. O'Reilly, 56 U.S. (15 How.) at 112-14. Moreover, it does not appear that a claim reciting a signal encoded with functional descriptive material falls within any of the categories of patentable subject matter set forth in Sec. 101.
>
> … a signal does not fall within one of the four statutory classes of Sec. 101.
>
> … signal claims are ineligible for patent protection because they do not fall within any of the four statutory classes of Sec. 101.

5. Claims 25 and 26 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claims 25 and 26 are drawn to functional descriptive material recorded on a recording medium. Normally, the claim would be statutory. However, the specification, at paragraph 94, lines 4-6 define the claimed recording medium as encompassing statutory media such as a "ROM",

"floppy disk", "CD-ROM", etc, as well as ***non-statutory*** subject matter such as a "carrier wave".

A "signal" embodying functional descriptive material is neither a process nor a product (i.e., a tangible "thing") and therefore does not fall within one of the four statutory classes of § 101. Rather, "signal" is a form of energy, in the absence of any physical structure or tangible material.

Because the full scope of the claim as properly read in light of the disclosure encompasses non-statutory subject matter, the claim as a whole is non-statutory. The examiner suggests amending the claim to *include* the disclosed tangible computer readable media, such as the ROM, while at the same time *excluding* the intangible media such as signals, carrier waves, etc. Any amendment to the claim should be commensurate with its corresponding disclosure.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1, 10, 13, 25, 27, 36, 39 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al. ("Robust quadtree-based disparity estimation…", SPIE article) and Thyagarajan et al. (US 6,529,634).

Regarding **claim 1**, Mancini et al. discloses a method of splitting an image block ("identify problematic blocks…and then split them" at section 6.5, paragraph 2, line 1) comprising:

setting a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) to compare with a characteristic ("average absolute DPD" at section 6.5.1, paragraph 3, line 10; "number of outliers" at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of a macro block ("block B_{ij}" at section 6.5.1, paragraph 3, line 4) in an image frame and determining thereby whether to split the macro block into sub blocks ("determine whether block B_{ij} requires splitting" at section 6.5.1, paragraph 3, line 6);

setting a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) to compare with a characteristic ("average absolute DPD" at section 6.5.1, paragraph 3, line 10; "number of outliers" at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of each sub block and determining thereby whether to split each sub block into smaller sub blocks ("Sub-blocks that will still fall on object boundaries can undergo further splitting" at section 6.5, paragraph 2, line 5).

Mancini et al. does not disclose that the plurality of splitting threshold values for each sub block is different than the plurality of splitting threshold values for a macroblock.

Thyagarajan et al. teaches a method of splitting an image block ("decision to subdivide a block" at col. 5, line 57) comprising:

setting a plurality of splitting threshold values to compare with a characteristic of a macro block in an image frame ("threshold T16 is modified to provide a new threshold T'16 if the mean value of the block is between two predetermined values" at col. 6, line 1); and

setting a plurality of other splitting threshold values to compare with a characteristic of each sub block ("variance threshold T8 is modified to provide a new threshold T'8 if the mean value of the block is between two predetermined values" at col. 6, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a different splitting threshold for the sub block from the macroblock as taught by Thyagarajan et al. to define the splitting thresholds of Mancini et al. to ensure that "small blocks are assigned even in relatively dark areas" (Thyagarajan et al. at col. 9, line 30) and to preserve "details in all areas that are above just noticeable visibility threshold" (Thyagarajan et al. at col. 9, line 31).

Regarding **claim 25**, Mancini et al. discloses a recording medium on which a method is written as a program code that can be read and executed on a computer (it is

inherent that the method is written on a recording medium to enable the method to performed), the program coded method of splitting an image block ("identify problematic blocks…and then split them" at section 6.5, paragraph 2, line 1) comprising:

setting a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) to compare with a characteristic ("average absolute DPD" at section 6.5.1, paragraph 3, line 10; "number of outliers" at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of a macro block ("block B_{ij}" at section 6.5.1, paragraph 3, line 4) in an image frame and determining thereby whether to split the macro block into sub blocks ("determine whether block B_{ij} requires splitting" at section 6.5.1, paragraph 3, line 6);

setting a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) to compare with a characteristic ("average absolute DPD" at section 6.5.1, paragraph 3, line 10; "number of outliers" at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of each sub block and determining thereby whether to split each sub block into smaller sub blocks ("Sub-blocks that will still fall on object boundaries can undergo further splitting" at section 6.5, paragraph 2, line 5).

Mancini et al. does not disclose that the plurality of splitting threshold values for each sub block is different than the plurality of splitting threshold values for a macroblock.

Thyagarajan et al. teaches a recording medium on which a method is written as a program code that can be read and executed on a computer (it is inherent that the method is written on a recording medium to enable the method to performed), the program coded method of splitting an image block ("decision to subdivide a block" at col. 5, line 57) comprising:

setting a plurality of splitting threshold values to compare with a characteristic of a macro block in an image frame ("threshold T16 is modified to provide a new threshold T'16 if the mean value of the block is between two predetermined values" at col. 6, line 1); and

setting a splitting threshold value to compare with a characteristic of each sub block ("variance threshold T8 is modified to provide a new threshold T'8 if the mean value of the block is between two predetermined values" at col. 6, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a different splitting threshold for the sub block from the macroblock as taught by Thyagarajan et al. to define the splitting thresholds of Mancini et al. to ensure that "small blocks are assigned even in relatively dark areas" (Thyagarajan et al. at col. 9, line 30) and to preserve "details in all areas that are above just noticeable visibility threshold" (Thyagarajan et al. at col. 9, line 31).

Regarding **claim 27**, Mancini et al. discloses an apparatus (an apparatus is inherent to carry out the function of the method) to split an image block ("identify problematic blocks…and then split them" at section 6.5, paragraph 2, line 1) comprising:

a macro block splitting determining unit (portion the apparatus that performs the steps of the algorithm) that sets a plurality of splitting threshold values (“The steps above rely on three threshold values” at section 6.5.1, paragraph 3, line 10) to compare with a characteristic (“average absolute DPD” at section 6.5.1, paragraph 3, line 10; “number of outliers” at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of a macro block (“block B_{ij}” at section 6.5.1, paragraph 3, line 4) in an image frame and determining therewith whether to split the macro block into sub blocks (“determine whether block B_{ij} requires splitting” at section 6.5.1, paragraph 3, line 6);

a sub block splitting determining unit (portion the apparatus that performs the steps of the algorithm) that sets a plurality of splitting threshold values (“The steps above rely on three threshold values” at section 6.5.1, paragraph 3, line 10) to compare with a characteristic (“average absolute DPD” at section 6.5.1, paragraph 3, line 10; “number of outliers” at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of each sub block and determining therewith whether to split each sub block into smaller sub blocks (“Sub-blocks that will still fall on object boundaries can undergo further splitting” at section 6.5, paragraph 2, line 5).

Mancini et al. does not disclose that the plurality of splitting threshold values for each sub block is different than the plurality of splitting threshold values for a macroblock.

Thyagarajan et al. teaches an apparatus ("system or apparatus and method of image compression" at col. 3, line 50) to split an image block ("decision to subdivide a block" at col. 5, line 57) comprising:

a macro block splitting determining unit (figure 2, numeral 206) that sets a plurality of splitting threshold values to compare with a characteristic of a macro block in an image frame ("threshold T16 is modified to provide a new threshold T'16 if the mean value of the block is between two predetermined values" at col. 6, line 1); and

a sub block splitting determining unit (figure 2, numeral 216) that sets a splitting threshold value to compare with a characteristic of each sub block ("variance threshold T8 is modified to provide a new threshold T'8 if the mean value of the block is between two predetermined values" at col. 6, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a different splitting threshold for the sub block from the macroblock as taught by Thyagarajan et al. to define the splitting thresholds of Mancini et al. to ensure that "small blocks are assigned even in relatively dark areas" (Thyagarajan et al. at col. 9, line 30) and to preserve "details in all areas that are above just noticeable visibility threshold" (Thyagarajan et al. at col. 9, line 31).

Regarding **claim 51**, Mancini et al. discloses a method of splitting a block comprising:

splitting macro image blocks ("determine whether block B_{ij} requires splitting" at section 6.5.1, paragraph 3, line 6) each of left-eye views and right eye views

("stereoscopic test images" at section 6.5, paragraph 1, line 2) into sub image blocks ("split them into four equal-sized sub-blocks" at section 6.5, paragraph 2, line 1) according to quadtree disparity estimation ("Quadtree disparity estimation" at section 6.5) using a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) and splitting each sub block into smaller sub blocks ("Sub-blocks that will still fall on object boundaries can undergo further splitting" at section 6.5, paragraph 2, line 5) according to quadtree disparity estimation ("Quadtree disparity estimation" at section 6.5) using a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10).

Mancini et al. does not disclose that the plurality of splitting threshold values for each sub block is different than the plurality of splitting threshold values for a macroblock.

Thyagarajan et al. teaches a method of splitting an image block ("decision to subdivide a block" at col. 5, line 57) comprising:

splitting macro image blocks into sub image blocks ("subdivided into four 8x8 blocks" at col. 6, line 12) using a plurality of splitting threshold values ("threshold T16 is modified to provide a new threshold T'16 if the mean value of the block is between two predetermined values" at col. 6, line 1); and

splitting each sub block into smaller sub blocks ("8x8 block is to be subdivided into four 4x4 blocks" at col. 6, line 25) using a plurality of other splitting threshold values

("variance threshold T8 is modified to provide a new threshold T'8 if the mean value of the block is between two predetermined values" at col. 6, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a different splitting threshold for the sub block from the macroblock as taught by Thyagarajan et al. to define the splitting thresholds of Mancini et al. to ensure that "small blocks are assigned even in relatively dark areas" (Thyagarajan et al. at col. 9, line 30) and to preserve "details in all areas that are above just noticeable visibility threshold" (Thyagarajan et al. at col. 9, line 31).

Regarding **claim 10**, Mancini et al. discloses a method wherein the image frame is a binocular image frame ("intermediate image I_I (Fig. 1) from the left-right image pair" at section 2, paragraph 2, line 4) representing a three dimensional image ("the '3D-ness' of the data" at section 1, paragraph 1, line 9).

Regarding **claim 13**, the Mancini et al. and Thyagarajan et al. combination discloses a method further comprising:

splitting the macro image block ("determine whether block B_{ij} requires splitting" Mancini et al. at section 6.5.1, paragraph 3, line 6) according to the determining by comparison with the thresholds and the other thresholds (steps of the algorithm in section 6.5.1) into sub image blocks ("split them into four equal-sized sub-blocks" Mancini et al. at section 6.5, paragraph 2, line 1) and into smaller sub blocks ("Sub-blocks that will still fall on object boundaries can undergo further splitting" Mancini et al. at section 6.5, paragraph 2, line 5) according to quadtree disparity estimation ("Quadtree disparity estimation" Mancini et al. at section 6.5).

Regarding **claim 36**, Mancini et al. discloses an apparatus wherein the image frame is a binocular image frame ("intermediate image I_I (Fig. 1) from the left-right image pair" at section 2, paragraph 2, line 4) representing a three dimensional image ("the '3D-ness' of the data" at section 1, paragraph 1, line 9).

Regarding **claim 39**, Mancini et al. discloses an apparatus wherein splitting of the macro block ("determine whether block B_{ij} requires splitting" at section 6.5.1, paragraph 3, line 6) and the sub block ("split them into four equal-sized sub-blocks" at section 6.5, paragraph 2, line 1) is performed using quadtree disparity estimation ("Quadtree disparity estimation" at section 6.5).

8. Claims 16, 19, 22, 26, 42, 45, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al., Thyagarajan et al. and Murashita et al. (US 6,304,606).

Regarding **claim 16**, Mancini et al. discloses a method of splitting an image block ("identify problematic blocks…and then split them" at section 6.5, paragraph 2, line 1) comprising:

setting a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) to compare with a characteristic ("average absolute DPD" at section 6.5.1, paragraph 3, line 10; "number of outliers" at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of a macro block ("block B_{ij}" at section 6.5.1, paragraph 3, line 4) in an image frame and determining thereby whether to split

the macro block into sub blocks ("determine whether block B_{ij} requires splitting" at section 6.5.1, paragraph 3, line 6);

setting a plurality of splitting threshold values ("The steps above rely on three threshold values" at section 6.5.1, paragraph 3, line 10) to compare with a characteristic ("average absolute DPD" at section 6.5.1, paragraph 3, line 10; "number of outliers" at section 6.5.1, paragraph 3, line 11; "ratio of the maximum to the minimum number of outliers" at section 6.5.1, paragraph 3, line 13) of each sub block and determining thereby whether to split each sub block into smaller sub blocks ("Sub-blocks that will still fall on object boundaries can undergo further splitting" at section 6.5, paragraph 2, line 5).

Mancini et al. does not disclose that the plurality of splitting threshold values for each sub block is different than the plurality of splitting threshold values for a macroblock.

Thyagarajan et al. teaches a method of splitting an image block ("decision to subdivide a block" at col. 5, line 57) comprising:

setting a plurality of splitting threshold values to compare with a characteristic of a macro block in an image frame ("threshold T16 is modified to provide a new threshold T'16 if the mean value of the block is between two predetermined values" at col. 6, line 1); and

setting a plurality of other splitting threshold values to compare with a characteristic of each sub block ("variance threshold T8 is modified to provide a new

threshold T'8 if the mean value of the block is between two predetermined values" at col. 6, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a different splitting threshold for the sub block from the macroblock as taught by Thyagarajan et al. to define the splitting thresholds of Mancini et al. to ensure that "small blocks are assigned even in relatively dark areas" (Thyagarajan et al. at col. 9, line 30) and to preserve "details in all areas that are above just noticeable visibility threshold" (Thyagarajan et al. at col. 9, line 31).

The Mancini et al. and Thyagarajan et al. combination does not disclose determining whether a macro block at a same location in a preceding image frame has been split and determining whether a sub block at a same location in a preceding image frame has been split.

Murashita et al. teaches a method of splitting an image block ("respective blocks obtained by dividing the image data" at col. 1, line 20) comprising:

determining whether to split the block ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" at col. 13, line 49) by determining whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the

same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" at col. 12, line 48).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the macro blocks and sub blocks of the Mancini et al. and Thyagarajan et al. combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

Regarding **claim 26**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a recording medium on which a method is written as a program code that can be read and executed on a computer (it is inherent that the method is written on a recording medium to enable the method to performed) that performs the method as described in the rejection of claim 16 above.

Regarding **claim 42**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses an apparatus (an apparatus is inherent to carry out the function of the method) that performs the method as described in the rejection of claim 16 above.

Regarding **claims 19 and 45**, Mancini et al. discloses a method and apparatus wherein the image frame is a binocular image frame ("intermediate image I_I (Fig. 1) from the left-right image pair" at section 2, paragraph 2, line 4) representing a three dimensional image ("the '3D-ness' of the data" at section 1, paragraph 1, line 9).

Regarding **claim 22**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a method further comprising:

splitting the macro block according to the determining of whether the macro block and sub blocks at respective same locations in the preceding image frame have been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" Murashita et al. at col. 12, line 48) using quadtree disparity estimation ("Quadtree disparity estimation" Mancini et al. at section 6.5)

Regarding **claim 48**, Mancini et al. discloses an apparatus wherein splitting of the macro block ("determine whether block B_{ij} requires splitting" at section 6.5.1, paragraph 3, line 6) and the sub block ("split them into four equal-sized sub-blocks" at section 6.5, paragraph 2, line 1) is performed using quadtree disparity estimation ("Quadtree disparity estimation" at section 6.5).

9. Claims 2, 3, 28, 29, 52, 56 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al. and Thyagarajan et al. as applied to claims 1, 25, 27 and 51 above, and further in view of Murashita et al.

Regarding **claim 2**, the Mancini et al. and Thyagarajan et al. combination discloses the elements of claim 1 as described in the 103 rejection above.

The Mancini et al. and Thyagarajan et al. combination does not disclose determining whether a macro block at a same location in a preceding image frame has been split.

Murashita et al. teaches a method of splitting an image block ("respective blocks obtained by dividing the image data" at col. 1, line 20) comprising:

determining whether to split the block ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" at col. 13, line 49) by determining whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" at col. 12, line 48).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the macro blocks of the Mancini et al. and Thyagarajan et al. combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

Regarding **claim 3**, the Mancini et al. and Thyagarajan et al. combination discloses the elements of claim 1 as described in the 103 rejection above.

The Mancini et al. and Thyagarajan et al. combination does not disclose determining whether a sub block at a same location in a preceding image frame has been split.

Murashita et al. teaches a method of splitting an image block ("respective blocks obtained by dividing the image data" at col. 1, line 20) comprising:

determining whether to split the block ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" at col. 13, line 49) by determining whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" at col. 12, line 48).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the sub blocks of the Mancini et al. and Thyagarajan et al. combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

Regarding **claim 28**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses an apparatus (an apparatus is inherent to carry out the function of the method) that performs the method as described in the rejection of claim 2 above.

Regarding **claim 29**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses an apparatus (an apparatus is inherent to carry out the function of the method) that performs the method as described in the rejection of claim 3 above.

Regarding **claim 52**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a recording medium on which a method is written as a program code that can be read and executed on a computer (it is inherent that the method is written on a recording medium to enable the method to performed) that performs the method as described in the rejection of claim 3 above.

Regarding **claim 56**, the Mancini et al. and Thyagarajan et al. combination discloses the elements of claim 51 as described in the 103 rejection above.

The Mancini et al. and Thyagarajan et al. combination does not disclose determining not to split the macro block if the macro block at a same location in a preceding image frame has not been split.

Murashita et al. teaches a method of splitting an image block ("respective blocks obtained by dividing the image data" at col. 1, line 20) comprising:

determining not to split the block (“When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded” at col. 13, line 31; “coding may be performed by using an orthogonal transform such as ADCT” at col. 13, line 49; coding is performed only on valid blocks) if the block at a

same location in a preceding image frame (“image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame” at col. 12, line 49) has not been split (unchanging background blocks are not coded and split, which propagates through refresh).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the macro blocks of the Mancini et al. and Thyagarajan et al. combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change” (Murashita et al. at col. 14, line 6).

Regarding **claim 57**, the Mancini et al. and Thyagarajan et al. combination discloses the elements of claim 51 as described in the 103 rejection above.

The Mancini et al. and Thyagarajan et al. combination does not disclose determining not to split the sub block if the sub block at a same location in a preceding image frame has not been split.

Murashita et al. teaches a method of splitting an image block ("respective blocks obtained by dividing the image data" at col. 1, line 20) comprising:

determining not to split the block (“When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded” at col. 13, line 31; “coding may be performed by using an orthogonal transform such as ADCT” at col. 13, line 49; coding is performed only on valid blocks) if the block at a same location in a preceding image frame (“image element of the first block of the

preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame" at col. 12, line 49) has not been split (unchanging background blocks are not coded and split, which propagates through refresh).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the sub blocks of the Mancini et al. and Thyagarajan et al. combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

10. Claims 4, 6, 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al. and Thyagarajan et al. as applied to claims 1 and 27 above, and further in view of Boyce (US 5,208,673).

Regarding **claim 4**, the Mancini et al. and Thyagarajan et al. combination discloses a method of splitting a block wherein the determining whether to split the macro block into sub blocks comprises:

determining a possibility of splitting a macro block ("determine whether block B_{ij} requires splitting" Mancini et al. at section 6.5.1, paragraph 3, line 6) by determining whether the ratio of maximum mean absolute difference (MAD) to minimum MAD of a sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) in the macro block is

greater than a threshold value from among the set splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block; and

determining whether to split the macro block by comparing the threshold value for determining the possibility of splitting the macro block ("Threshold θ_2" Mancini et al. at section 6.5.1, paragraph 3, line 11), and comparing the ratio of maximum MAD to minimum MAD, and a threshold value for determining whether to split the macro block with one another ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13), if a ratio is greater than the threshold for determining the possibility of splitting the macro block ("if $\Sigma \kappa_i < \theta_2$ then do not split, otherwise continue" Mancini et al. at section 6.5.1, paragraph 3, line 8; "tolerable number of outliers as a fraction of the block size" Mancini et al. at section 6.5.1, paragraph 3, line 11),

The Mancini et al. and Thyagarajan et al. combination does not teach comparing the threshold value for determining the possibility of splitting the macro block with the ratio of maximum MAD to minimum MAD, and that the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD.

Boyce discloses a method comprising:

comparing the threshold value for determining the possibility of splitting the macro block ("determined value B" at col. 4, line 44) with the ratio ("ratio of MAD_o

/MAD_{min}" at col. 4, line 56) of maximum MAD ("MAD_o is the mean of the absolute differences between pixels in the block in a reference frame for which noise is to be reduced and the pixels in a block having the same position in another frame" at col. 4, line 28) to minimum MAD ("The matching block is the one having the minimum value of mean absolute difference, MAD, which is MAD_{min}" at col. 4, line 34),

the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al. and Thyagarajan et al. combination to be compared using the ratio taught by Boyce as described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

Regarding **claim 6**, the Mancini et al. and Thyagarajan et al. combination discloses a method of splitting a block wherein the determining of whether to split each sub block into smaller sub blocks comprises:

determining a possibility of splitting a sub block ("determine whether block B_{ij} requires splitting" Mancini et al. at section 6.5.1, paragraph 3, line 6) by determining whether a ratio of maximum mean absolute difference (MAD) to minimum MAD of the smaller sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section

6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) is greater than a threshold value from among the other set splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the sub block; and

determining whether to split the sub block by determining whether a ratio is greater than the threshold for determining the possibility of splitting the sub block ("if $\Sigma \kappa_i < \theta_2$ then do not split, otherwise continue" Mancini et al. at section 6.5.1, paragraph 3, line 8; "tolerable number of outliers as a fraction of the block size" Mancini et al. at section 6.5.1, paragraph 3, line 11),

The Mancini et al. and Thyagarajan et al. combination does not teach that the ratio greater than the threshold for determining the possibility of splitting the sub block is the ratio of maximum MAD to minimum MAD.

Boyce discloses a method comprising:

the ratio greater than the threshold for determining the possibility of splitting the sub block is the ratio of maximum MAD to minimum MAD ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al. and Thyagarajan et al. combination to be compared using the ratio taught by Boyce as described above, such

that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

Regarding **claim 30**, the Mancini et al. and Thyagarajan et al. combination discloses an apparatus (an apparatus is inherent to carry out the function of the method) and a method of splitting a block wherein the determining whether to split the macro block into sub blocks comprises:

a macro block splitting possibility determining portion (portion of apparatus that performs algorithm of section 6.5.1) that determines whether the ratio of maximum mean absolute difference (MAD) to minimum MAD of a sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) in the macro block is greater than a threshold value from among the macro block splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block; and

a macro block splitting determining portion (portion of apparatus that performs algorithm of section 6.5.1) that, if a ratio is greater than the threshold for determining the possibility of splitting the macro block ("if $\Sigma \kappa_i < \theta_2$ then do not split, otherwise continue" Mancini et al. at section 6.5.1, paragraph 3, line 8; "tolerable number of outliers as a fraction of the block size" Mancini et al. at section 6.5.1, paragraph 3, line 11), determines whether to split the macro block by comparing the threshold value for determining the possibility of splitting the macro block ("Threshold θ_2" Mancini et al. at

section 6.5.1, paragraph 3, line 11), and comparing the ratio of maximum MAD to minimum MAD, and a threshold value from among the macro block splitting threshold values for determining whether to split the macro block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13),

The Mancini et al. and Thyagarajan et al. combination does not teach comparing the threshold value for determining the possibility of splitting the macro block with the ratio of maximum MAD to minimum MAD, and that the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD.

Boyce discloses a method comprising:

comparing the threshold value for determining the possibility of splitting the macro block ("determined value B" at col. 4, line 44) with the ratio ("ratio of MAD_o /MAD_{min}" at col. 4, line 56) of maximum MAD ("MAD_o is the mean of the absolute differences between pixels in the block in a reference frame for which noise is to be reduced and the pixels in a block having the same position in another frame" at col. 4, line 28) to minimum MAD ("The matching block is the one having the minimum value of mean absolute difference, MAD, which is MAD_{min}" at col. 4, line 34),

the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due

to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al. and Thyagarajan et al. combination to be compared using the ratio taught by Boyce as described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

Regarding **claim 32**, the Mancini et al. and Thyagarajan et al. combination discloses a method of splitting a block wherein the determining of whether to split each sub block into smaller sub blocks comprises:

a sub block splitting possibility determining portion (portion of apparatus that performs algorithm of section 6.5.1) that determines whether a ratio of maximum mean absolute difference (MAD) to minimum MAD of the smaller sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) is greater than a threshold value from among the sub block splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the sub block; and

a sub block splitting determining portion (portion of apparatus that performs algorithm of section 6.5.1) that, if a ratio is greater than the threshold for determining the possibility of splitting the sub block ("if $\Sigma \kappa_i < \theta_2$ then do not split, otherwise continue" Mancini et al. at section 6.5.1, paragraph 3, line 8; "tolerable number of outliers as a

fraction of the block size" Mancini et al. at section 6.5.1, paragraph 3, line 11), determines whether to split the sub block by comparing the threshold value for determining the possibility of splitting the sub block ("Threshold θ_2" Mancini et al. at section 6.5.1, paragraph 3, line 11), and comparing the ratio of maximum MAD to minimum MAD, and a threshold value from among the sub block splitting threshold values for determining whether to split the sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13),

The Mancini et al. and Thyagarajan et al. combination does not teach comparing the threshold value for determining the possibility of splitting the sub block with the ratio of maximum MAD to minimum MAD, and that the ratio greater than the threshold for determining the possibility of splitting the sub block is the ratio of maximum MAD to minimum MAD.

Boyce discloses a method comprising:

comparing the threshold value for determining the possibility of splitting the sub block ("determined value B" at col. 4, line 44) with the ratio ("ratio of MAD_o /MAD_{min}" at col. 4, line 56) of maximum MAD ("MAD_o is the mean of the absolute differences between pixels in the block in a reference frame for which noise is to be reduced and the pixels in a block having the same position in another frame" at col. 4, line 28) to minimum MAD ("The matching block is the one having the minimum value of mean absolute difference, MAD, which is MAD_{min}" at col. 4, line 34),

the ratio greater than the threshold for determining the possibility of splitting the sub block is the ratio of maximum MAD to minimum MAD ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al. and Thyagarajan et al. combination to be compared using the ratio taught by Boyce as described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

11. Claims 17, 18, 43, 44 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al., Thyagarajan et al. and Murashita et al. as applied to claims 16 and 42 above, and further in view of Boyce.

Regarding **claim 17**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a method wherein determining whether to split the macro block according to whether a macro block has been split in a preceding image frame at the same location comprises:

determining a possibility of splitting the macro block ("determine whether block B_{ij} requires splitting" Mancini et al. at section 6.5.1, paragraph 3, line 6) by determining whether a ratio of maximum mean absolute difference (MAD) to minimum MAD of a sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1,

paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) in the macro block is greater than a threshold value from among the set macro block splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block,

determining whether the ratio of maximum of maximum MAD to minimum MAD is less than the threshold value for determining whether to split the macro block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13),

determining whether the macro block at the same location in the preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" Murashita et al. at col. 12, line 48) if the ratio is less than the threshold value for determining whether to split the macro block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9),

determining not to split the macro block if the macro block at the same location in the preceding image frame has not been split and determining to split the macro block if the macro block at the same location in the preceding image frame has been split

("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" Murashita et al. at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" Murashita et al. at col. 13, line 49; coding is performed only on valid blocks).

The Mancini et al., Thyagarajan et al. and Murashita et al. combination does not teach a method

determining whether the ratio of maximum MAD to minimum MAD is between the threshold value for determining the possibility of splitting the macro block and another threshold value from among the set macro block splitting threshold values for determining whether to split the macro block; and

determining whether the preceding macro block has been split if the ratio is between the threshold value and the other threshold value.

However, by determining whether the ratio is greater than the threshold value for determining the possibility of splitting the macro block (and subsequently the threshold value for determining the possibility of splitting the sub block), prior to determining whether the ratio of maximum of maximum MAD to minimum MAD is less than the threshold value for determining whether to split the macro block (and subsequently for the sub block), one would thereby determine whether the ratio is in between the two thresholds. If so, then determination of whether the preceding macro block (and subsequently sub block) has been split can occur.

Boyce discloses a method comprising determining whether the ratio of maximum MAD to minimum MAD ("ratio of MAD_o /MAD_{min}" at col. 4, line 56) is greater than the

threshold value ("determined value B" at col. 4, line 44) for determining the possibility of splitting the macro block ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al., Thyagarajan et al. and Murashita et al. combination to be compared using the ratio taught by Boyce as described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

Regarding **claim 18**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a method wherein determining of whether to split the sub block into smaller sub blocks by determining whether the sub block has been split in a preceding image frame at the same location comprises:

determining a possibility of splitting the sub block ("determine whether block B_{ij} requires splitting" Mancini et al. at section 6.5.1, paragraph 3, line 6) by determining whether a ratio of maximum mean absolute difference (MAD) to minimum MAD of a sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) in the macro block is greater than a threshold value from among the set sub block splitting threshold values

("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block,

determining whether the ratio of maximum of maximum MAD to minimum MAD is less than the threshold value for determining whether to split the sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13),

determining whether the sub block at the same location in the preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" Murashita et al. at col. 12, line 48) if the ratio is less than the threshold value for determining whether to split the sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9),

determining not to split the sub block if the sub block at the same location in the preceding image frame has not been split and determining to split the sub block if the sub block at the same location in the preceding image frame has been split ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" Murashita et al. at col. 13, line 31; "coding may be

performed by using an orthogonal transform such as ADCT" Murashita et al. at col. 13, line 49; coding is performed only on valid blocks).

The Mancini et al., Thyagarajan et al. and Murashita et al. combination does not teach a method

determining whether the ratio of maximum MAD to minimum MAD is between the threshold value for determining the possibility of splitting the sub block and another threshold value from among the set sub block splitting threshold values for determining whether to split the sub block; and

determining whether the preceding sub block has been split if the ratio is between the threshold value and the other threshold value.

However, by determining whether the ratio is greater than the threshold value for determining the possibility of splitting the sub block, prior to determining whether the ratio of maximum of maximum MAD to minimum MAD is less than the threshold value for determining whether to split the sub block, one would thereby determine whether the ratio is in between the two thresholds. If so, then determination of whether the preceding sub block has been split can occur.

Boyce discloses a method comprising determining whether the ratio of maximum MAD to minimum MAD ("ratio of MAD_o /MAD_{min}" at col. 4, line 56) is greater than the threshold value ("determined value B" at col. 4, line 44) for determining the possibility of splitting the sub block ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if

the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al., Thyagarajan et al. and Murashita et al. combination to be compared using the ratio taught by Boyce as described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

Regarding **claim 43**, the Mancini et al., Thyagarajan et al., Murashita et al. and Boyce combination discloses an apparatus (an apparatus is inherent to carry out the function of the method) that performs the method as described in the rejection of claim 17 above.

Regarding **claim 44**, the Mancini et al., Thyagarajan et al., Murashita et al. and Boyce combination discloses an apparatus (an apparatus is inherent to carry out the function of the method) that performs the method as described in the rejection of claim 18 above.

Regarding **claim 53**, Mancini et al. discloses an apparatus wherein the macro block splitting determining unit comprises:

a macro block splitting possibility determiner (portion of apparatus that performs algorithm of section 6.5.1) that determines whether the ratio of maximum mean absolute difference (MAD) to minimum MAD of the sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" at section 6.5.1, paragraph 3, line 13) in the

macro block is greater than a threshold value from among the macro block splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block.

12. Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al., Thyagarajan et al. and Murashita et al. as applied to claims 2 and 3 above, and further in view of Boyce.

Regarding **claim 5**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a method of splitting a block wherein the determining of whether to split the macro block into sub blocks comprises:

determining a possibility of splitting the macro block ("determine whether block B_{ij} requires splitting", Mancini et al. at section 6.5.1, paragraph 3, line 6) by determining whether the ratio of maximum mean absolute difference (MAD) to minimum MAD of a sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) in the macro block is greater than a threshold value from among the set splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block; and

determining whether to split the macro block by comparing the threshold value for determining the possibility of splitting the macro block ("Threshold θ_2" Mancini et al. at section 6.5.1, paragraph 3, line 11), and comparing the ratio of maximum MAD to

minimum MAD, and a threshold value for determining whether to split the macro block with one another ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13), if a ratio is greater than the threshold value for determining the possibility of splitting the macro block ("if $\Sigma \kappa_i < \theta_2$ then do not split, otherwise continue" Mancini et al. at section 6.5.1, paragraph 3, line 8; "tolerable number of outliers as a fraction of the block size" Mancini et al. at section 6.5.1, paragraph 3, line 11) in the operation of setting a plurality of splitting threshold values ("The steps above rely on three threshold values" Mancini et al. at section 6.5.1, paragraph 3, line 10) for the macro block ("block B_{ij}" Mancini et al. at section 6.5.1, paragraph 3, line 4) in the image frame and determining whether to split the macro block into the sub blocks ("determine whether block B_{ij} requires splitting" Mancini et al. at section 6.5.1, paragraph 3, line 6).

The Mancini et al., Thyagarajan et al. and Murashita et al. combination does not teach comparing the threshold value for determining the possibility of splitting the macro block with the ratio of maximum MAD to minimum MAD and that the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD.

Boyce discloses a method comprising

comparing the threshold value for determining the possibility of splitting the macro block ("determined value B" at col. 4, line 44) with the ratio ("ratio of MAD_o /MAD_{min}" at col. 4, line 56) of maximum MAD ("MAD_o is the mean of the absolute

differences between pixels in the block in a reference frame for which noise is to be reduced and the pixels in a block having the same position in another frame" at col. 4, line 28) to minimum MAD ("The matching block is the one having the minimum value of mean absolute difference, MAD, which is MAD_{min}" at col. 4, line 34),

the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al., Thyagarajan et al. and Murashita et al. combination to be compared using the ratio taught by Boyce as described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

Regarding **claim 7**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses a method of splitting a block wherein the determining of whether to split each sub block into smaller sub blocks comprises:

determining a possibility of splitting the sub block ("determine whether block B_{ij} requires splitting", Mancini et al. at section 6.5.1, paragraph 3, line 6) by determining whether a ratio of maximum mean absolute difference (MAD) to minimum MAD of a sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9; "ratio of the maximum to the minimum number of outliers in the four

sub-blocks" Mancini et al. at section 6.5.1, paragraph 3, line 13) in the macro block is greater than a threshold value from among the set other splitting threshold values ("threshold value θ_3" Mancini et al. at section 6.5.1, paragraph 3, line 12) for determining the possibility of splitting the macro block; and

determining whether to split the sub block by determining whether a ratio is greater than the threshold for determining the possibility of splitting the sub block ("if $\Sigma \kappa_i < \theta_2$ then do not split, otherwise continue" Mancini et al. at section 6.5.1, paragraph 3, line 8; "tolerable number of outliers as a fraction of the block size" Mancini et al. at section 6.5.1, paragraph 3, line 11),

The Mancini et al., Thyagarajan et al. and Murashita et al. combination does not teach that the ratio greater than the threshold for determining the possibility of splitting the macro block is the ratio of maximum MAD to minimum MAD.

Boyce discloses a method comprising:

the ratio greater than the threshold for determining the possibility of splitting the sub block is the ratio of maximum MAD to minimum MAD ("If the ratio of MAD_o /MAD_{min} is less than B, it is considered that the differences between the blocks are due to noise" at col. 4, line 56; consequently, if the ratio is greater than B, the differences are considerable enough to be further processed).

It would have been obvious at the time the invention was made to one of ordinary skill in the art for the threshold value of the Mancini et al., Thyagarajan et al. and Murashita et al. combination to be compared using the ratio taught by Boyce as

described above, such that a block "caused by a poor motion estimate such as due to a change in scene so that it is not included" (Boyce at column 2, line 49).

13. Claims 8, 9, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mancini et al., Thyagarajan et al. and Boyce as applied to claims 4, 6, 30 and 32 above, and further in view of Murashita et al.

Regarding **claim 8**, the Mancini et al., Thyagarajan et al. and Boyce combination discloses a method wherein determining of whether to split the macro block comprises:

determining whether the ratio of maximum of maximum MAD to minimum MAD is between the threshold value for determining the possibility of splitting the macro block and another threshold value from among the set splitting threshold values for determining whether to split the macro block (see rejection of claim 17)

determining if the ratio is less than the threshold value for determining whether to split the macro block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9),

determining to split the macro block if the ratio is between the threshold value and the other threshold value (see rejection of claim 17).

The Mancini et al., Thyagarajan et al. and Boyce combination does not disclose determining whether a macro block at a same location in a preceding image frame has been split and determining not to split the macro block if the macro block at the same location in the preceding image frame has not been split, and determining to split the

macro block if the macro block at the same location in the preceding image frame has been split.

Murashita et al. discloses a method comprising:

determining whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" at col. 12, line 48); and

determining not to split the block if the block at the same location in the preceding image frame has not been split, and determining whether to split the block if the block at the same location in the preceding image frame has been split ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" at col. 13, line 49; coding is performed only on valid blocks).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the macro blocks of the Mancini et al., Thyagarajan et al. and Boyce combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

Regarding **claim 9**, the Mancini et al., Thyagarajan et al. and Boyce combination discloses a method wherein determining of whether to split the sub block comprises:

determining whether the ratio of maximum of maximum MAD to minimum MAD is between the threshold value for determining the possibility of splitting the sub block and another threshold value from among the set splitting threshold values for determining whether to split the sub block (see rejection of claim 18)

determining if the ratio is less than the threshold value for determining whether to split the sub block ("$\max(\kappa_i, i = 1,\ldots,4)/\min(\kappa_i, I = 1,\ldots,4) < \theta_3$" Mancini et al. at section 6.5.1, paragraph 3, line 9),

determining to split the sub block if the ratio is between the threshold value and the other threshold value (see rejection of claim 18).

The Mancini et al., Thyagarajan et al. and Boyce combination does not disclose determining whether a sub block at a same location in a preceding image frame has been split and determining not to split the sub block if the sub block at the same location in the preceding image frame has not been split, and determining to split the sub block if the sub block at the same location in the preceding image frame has been split.

Murashita et al. discloses a method comprising:

determining whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block

in which the image is different from that in the first block of the preceding frame" at col. 12, line 48); and

determining not to split the block if the block at the same location in the preceding image frame has not been split, and determining whether to split the block if the block at the same location in the preceding image frame has been split ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" at col. 13, line 49; coding is performed only on valid blocks).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the sub blocks of the Mancini et al., Thyagarajan et al. and Boyce combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

Regarding **claim 34**, the Mancini et al., Thyagarajan et al. and Boyce combination discloses an apparatus, wherein the macro block splitting determining portion comprises:

a determiner for determining that the ratio of maximum of maximum MAD to minimum MAD is between the threshold value for determining the possibility of splitting the macro block and the threshold value for determining whether to split the macro block (see rejection of claim 17).

The Mancini et al., Thyagarajan et al. and Boyce combination does not disclose a preceding macro block splitting determiner that determines whether the macro block at a same location in a preceding image frame has been split and a macro block splitting final determiner that finally determines not to split the macro block if the macro block at the same location in the preceding image frame has not been split, and determines to split the macro block if the macro block at the same location in the preceding image frame has been split.

Murashita et al. discloses an apparatus comprising:

a preceding macro block splitting determiner (portion of apparatus that performs figure 6) that determines whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" at col. 12, line 48); and

a macro block splitting final determiner (portion of apparatus that performs figure 6) that finally determines not to split the block if the block at the same location in the preceding image frame has not been split, and determining whether to split the block if the block at the same location in the preceding image frame has been split ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using

an orthogonal transform such as ADCT" at col. 13, line 49; coding is performed only on valid blocks).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the macro blocks of the Mancini et al., Thyagarajan et al. and Boyce combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

Regarding **claim 35**, the Mancini et al., Thyagarajan et al. and Boyce combination discloses an apparatus, wherein the sub block splitting determining portion comprises:

a determiner for determining that the ratio of maximum of maximum MAD to minimum MAD is between the threshold value for determining the possibility of splitting the sub block and the threshold value for determining whether to split the sub block (see rejection of claim 18).

The Mancini et al., Thyagarajan et al. and Boyce combination does not disclose a preceding sub block splitting determiner that determines whether the sub block at a same location in a preceding image frame has been split and a sub block splitting final determiner that finally determines not to split the sub block if the sub block at the same location in the preceding image frame has not been split, and determines to split the sub block if the sub block at the same location in the preceding image frame has been split.

Murashita et al. discloses an apparatus comprising:

a preceding sub block splitting determiner (portion of apparatus that performs figure 6) that determines whether a block at a same location in a preceding image frame has been split ("the image element in the first block of the present frame is compared with the image element of the first block of the preceding frame with the position of the image element and block of the present frame being the same as those of the preceding frame, thereby determining whether the first block of the present frame is a valid block in which the image is different from that in the first block of the preceding frame" at col. 12, line 48); and

a sub block splitting final determiner (portion of apparatus that performs figure 6) that finally determines not to split the block if the block at the same location in the preceding image frame has not been split, and determining whether to split the block if the block at the same location in the preceding image frame has been split ("When the image data of the present frame changes from that of the preceding frame, the image data of the first block is coded" at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" at col. 13, line 49; coding is performed only on valid blocks).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the block comparison of Murashita et al. on the sub blocks of the Mancini et al., Thyagarajan et al. and Boyce combination as "the amount of coded data can be reduced greatly in the case of the frame including a large background portion in which the image does not change" (Murashita et al. at col. 14, line 6).

14. Claims 54 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Mancini et al., Thyagarajan et al. and Murashita et al. as applied to claim 42 above, and further in view of common knowledge in the art.

Regarding **claim 54**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses the elements of claim 42 as shown in the 103 rejection above.

The Mancini et al., Thyagarajan et al. and Murashita et al. combination does not explicitly disclose

determining that the ratio of maximum to minimum MAD is between the threshold value for determining the possibility of splitting the macro block and a threshold value for determining whether to split the macro block.

However, by determining whether the ratio is greater than the threshold value for determining the possibility of splitting the macro block (and subsequently the threshold value for determining the possibility of splitting the sub block), prior to determining whether the ratio of maximum of maximum MAD to minimum MAD is less than the threshold value for determining whether to split the macro block (and subsequently for the sub block), one would thereby determine whether the ratio is in between the two thresholds. If so, then determination of whether the preceding macro block (and subsequently sub block) has been split can occur.

Regarding **claim 55**, the Mancini et al., Thyagarajan et al. and Murashita et al. combination discloses determining not to split the macro block if the preceding macro block has not been split and determining to split the macro block if the preceding macro block has been split ("When the image data of the present frame changes from that of

the preceding frame, the image data of the first block is coded" Murashita et al. at col. 13, line 31; "coding may be performed by using an orthogonal transform such as ADCT" Murashita et al. at col. 13, line 49; coding is performed only on valid blocks).

Response to Arguments

Summary of Remarks (@ response page labeled 18): The Mancini reference does not disclose using sub block thresholds that are different from macro block thresholds.

Examiner's Response: This is addressed using a new reference and is therefore moot.

Summary of Remarks (@ response page labeled 18): The Mancini reference does not disclose "'setting a plurality of splitting thresholds to compare with a characteristic of a macro block'".

Examiner's Response: As stated in the rejection above, the thresholds are set such that a comparison to various characteristics of the macro block can commence. In particular, the characteristics are highlighted in the rejection above.

Summary of Remarks (@ response page labeled 18): The Mancini reference does not disclose a "'macro block splitting determining unit'".

Examiner's Response: As stated in the rejection above, the apparatus contains a section that performs the functions of that particular unit.

Summary of Remarks (@ response page labeled 18): The Mancini reference does not disclose the steps of determining whether to split the macro/sub blocks and splitting the macro blocks according to quadtree disparity estimation using a plurality of splitting threshold values.

Examiner's Response: As stated in the rejections above, the Mancini reference determines whether to split the macro/sub blocks after the thresholds have been set, using quadtree disparity estimation.

Summary of Remarks (@ response pages 19-21): The Keith reference does not disclose determining whether a macro/sub block has been split in a preceding frame.

Examiner's Response: The Keith reference is no long being relied upon for this particular limitation.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATRINA FUJITA whose telephone number is (571)270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katrina Fujita/
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/Vikkram Bali/
Supervisory Patent Examiner, Art Unit 2624